Examiners' Report
Principal Examiner Feedback

Summer 2023

Pearson Edexcel Level 3 Certificate
In Mathematics in Context (7MC0) Paper 2

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Introduction

Candidates appeared to be well prepared for this exam with no evidence seen of candidates lacking equipment such as calculators and being disadvantaged. Candidates, overall, attempted many questions, indicating they had completed the course content and were comfortable with large parts of the additional knowledge from GCSE.

As is often the case at GCSE topics that are presented as part of a problem, or in an unfamiliar context prove a challenge to many and indicate that candidates may need to spend more time developing their understanding of the mathematics. There is also evidence that candidates need to continue to work on answering questions where a written response or explanation is required. Their ability to talk mathematically lacks confidence in many cases and as a result leads to muddled or contradictory responses. Some produced responses that were barely legible and difficult to decipher. It was good to see that many of the candidates who struggled with, or omitted, earlier parts of the long questions, still made attempts and often scored marks on some of the following sections.

Report on Individual Questions

Question 1

(a) the majority of candidates had some knowledge of how to calculate Spearman's' Rank, and as a result were able to gain a number of marks in (i). Most either knew the formula or copied it from the source booklet. Unfortunately, some did not use the lay out of the table to their advantage and struggled to rank the Net transfer spend. Others predictably made errors when squaring negative differences, obtaining negative answers, this resulted in them losing the 3rd Method mark. It is worth noting, that as guidance was not given on ranking, candidates were able to gain full marks on part (i) if they ranked the Net Transfer spend in an ascending or descending way, and this was reflected in the markscheme. Substitution in the formula was generally correct, although some made errors, possibly due to poor calculator work.

Part (ii) required candidates to interpret their value for the Spearman's' Rank and most were able to gain the one mark available for a suitable response. It is worth candidates noting that a score of near to zero represents little or no correlation between the variables. A small number of candidates incorrectly believed that a negative result meant there was no correlation.

(b) was typically answered well by most candidates recognising that a score nearer to 1 or −1 represents a stronger correlation. Candidates who had an incorrect value in part (a)(i) were able to still gain this mark if they interpreted this value correctly in relation to the value given in part (b).

(c) proved to be quite a challenge due to the context of the question. The question was looking for candidates to recognise the negative correlation and interpret that to mean that the higher the wage bill, the lower the value of the league position. This was confused slightly as we normally interpret a lower value of league position as being a higher position (higher up the table). Candidates were not penalised for this though as long as interpretations were correct.

Question 2

(a) required candidates to explain why a linear model wasn't appropriate and many were able to recognise that the fluctuating nature of the data was the cause for this. As with many of these questions, the clarity of the mathematical language was sometimes lacking, and this held some candidates back.
(b) was about the use of a given model to predict attendance each year. In (i) the candidate had to retrieve a value from the source booklet and interpret this in context. Some candidates struggled to correctly interpret the value of t and simply substituted 1993 into the model rather than subtracting first. (ii) wanted candidates to use the formula to predict a value for 2023. Again, those who struggled to interpret the value of t lost marks but were able to gain the first mark. To achieve the second, the substitution needed to be complete and correct.
For the final part, candidates needed to interpret the long-term reliability of the model and it was pleasing to see many good responses. Many candidates were able to give correct examples of external factors that may affect this. It is worth noting that an example was needed, and just stating external factors was not sufficient.
Part (c) required the candidates to use a second model, and many candidates found this model more difficult to deal with. Again, many struggled with the interpretation of the value of t. In part (i) the two method marks were given for substitution and for rearrangement, and could be awarded in either order, and were independent of each other. This meant that those who made a mistake with their substitution were still able to gain credit for the processes needed to rearrange, to isolate B. Despite this there were many instances of inaccurate rearrangement.
In (ii) candidates had to use their given value of B and find a value for 2023. With only 2 marks available, those who misinterpreted time were unable to gain any credit in this part. The final part of the question required candidates to realise that the value of 1.09^{-t} will tend to zero as t increases and therefore the maximum attendance will be 40400. It was clear that candidates generally did not understand this and as a result there were many who didn't score this mark.

Question 3

This question required candidates to form and solve a pair of linear simultaneous equations. This should be a topic that is very familiar to candidates from Higher GCSE, and it was pleasing to see that for many it was, and they were able to gain full marks. It is worth highlighting that those who struggled, probably provide evidence of limited time being given to reviewing topics previously covered at GCSE.
Most candidates were able to gain the first mark for forming two suitable equations. Due to the nature of the equations formed and all coefficients being positive, it meant fewer conceptual mistakes were seen than we would expect with negatives. This meant that overall, those who understood the process of elimination gained the first two marks more often than not. Those who got this far, typically gained the 3rd mark, for the substitution as a process to solve for the second variable, with only arithmetic errors leading to a lack of accuracy for most.
Although, substitution is a perfectly valid method for solving simultaneous equations. Many of those who attempted this method, quickly made mistakes in their algebra and as such; often failed to gain much, or any credit for their working. Weaker candidates often failed to write any equations, using no algebra at all, and a combination of guesswork, trial and Improvement with no success.

Question 4

Part (a) required the interpretation of some given information to complete a Venn diagram. There was very little in the way of calculations required and as such should have provided a good way of achieving three marks for most candidates and, pleasingly it did. Part (b) was made up of three, one-mark questions asking for interpretation and use of notation. Again, it was pleasing to see that many candidates scored all three marks, and this is clearly a topic that has been well remembered from GCSE, or well-practised prior to this paper. If any mark was dropped it was typically the second, for use of notation, and it was typical to see the use of the union symbol rather than the intersection symbol.

Part (c) proved to be more challenging to many candidates. Most achieved the first mark for correctly placing the 0.6 and 0.96. However, many simply repeated probabilities on the bottom branch, rather than going back to the Venn diagram, or the information above, to calculate the required probabilities. Weaker candidates did not appear to recognize that the probabilities on the 2 branches on part of a tree diagram should add up to one. It was perhaps, surprising to see so many candidates not realising that the blood pressure after the trial is clearly affected by the medicine being given.

In part (d) candidates were required to assess a claim. This was simpler than many thought. We saw a significant proportion of candidates calculating probabilities by multiplying. However, all that was required was to compare 2 values from the tree diagram. In all, this meant that only 1 mark was achieved by many candidates for recognising the correct values to use. There were several ways the correct comparison could be made, and these were all shown in the mark scheme.

Question 5

This problem required candidates to work with probability and costings to draw a conclusion on the best way to maximise profits for a company. It was really pleasing to see so many candidates understand the information and to interpret it correctly. The first mark was for working with probability for one factory to find the expected profit for one year, for one demand. To gain the second mark candidates needed to find the expected profit over 5 years for one of the factories. Some started to struggle here as they began to prematurely bring in the costings and started deducting them for each year. The final method mark was for working fully, for one factory and was done well by many. To gain the final mark candidates had to repeat the process for the second factory and draw a correct conclusion from accurate figures. Those who gained 3 normally gained 4. Those candidates who didn't understand the relevance of the probability and worked without them gained no credit at all. These candidates usually tried to compare eventualities for low demand or high demand as though they had an equal chance of happening.

Question 6

This question should have provided a very familiar feel to candidates from Higher GCSE with many of the marks being assigned to topics that had been studied previously. Part (a) and (b) provided a simple 1 mark for stating the modal class and for finding a single frequency density. Most candidates were correct with (a) but (b) was often missed out, incorrect, or the division was inverted. Part (c) required them to use their found FD and use it to scale the axis on the incomplete Histogram; again, many could not do this. Part

(d) required candidates to use the Frequency table and their scale to complete the histogram. With both bars being the same width, it helped candidates do well on this and many did. Many had an incorrect scale, but their bars compared correctly with those already on the diagram. There were some blank responses, but they typically came from candidates who had not scored the previous two marks.

Part (e) proved to be very familiar to many with 4 marks available for an estimated mean. Although many did score heavily on this part, it is perhaps disappointing to see so many making the same mistakes we would expect to see at GCSE, such as not using the midpoint, or dividing by the sum of the midpoints rather than the sum of the frequencies. Candidates and centres must see these familiar topics, as areas to maximise success and provide time to review and practice.
Although part (f) used standard deviation, no knowledge of this was required and candidates simply needed to substitute a given value, and their answer to part (e) to gain success. Part (g) is a topic that candidates find hard at GCSE and do here also. Interpolation using the table, or estimating using the Histogram were both acceptable methods, but many struggled to gain any foothold in the question. Interpolation in not on the GCSE specification, and as such it would be no surprise to see candidates regularly using the graph, but in this case, few responses worthy of credit, from either method, were seen.

Question 7

Part (a) was testing candidates' ability to apply repeated percentage change, and with this being a topic at relatively low grade at GCSE, it was surprising to see that candidates were often using very long winded, or incorrect methods to find the required value. The allocation of only 2 marks should be used as an indicator that only one step of working is really required.
(b) was looking at working with this context as a geometric progression and using the formula to find the sum. Those candidates who recognised this were able to quickly gain all three marks. It was more common however to see candidates attempt to sum values found in part (a). However, this often only led to 1 mark as it was common to see candidates adding an extra term or missing a term in their sum. Part (c) was answered quite poorly, with most candidates not working with a geometric progression, and so not using the correct formula. This normally led to candidates trying to provide a written explanation, which was not sufficient to gain any credit.

Question 8

Linear programming provides a challenge for many candidates with very mixed success being evident. In part (a) candidates were required to form 3 linear inequalities, and this seems to be an area for improvement for many. It was common for candidates to gain 1 or 2 marks for finding the first inequality. Many of those who only gained 1 mark, incorrectly gave coefficients as decimals or failed to convert the units to kg for the total amount of cotton. The final 3 marks were for the other two inequalities and very few candidates were able to work correctly with the percentage (or decimal). Answers like $0.2x \geq y + z$ or $0.6x \leq y + z$ were very common and got no credit. To gain all of these marks, candidates had to convert all coefficients to integers, and many failed to read that instruction.

Part (b) was probably the best answered part of the whole of question 8, with most candidates providing a suitable objective function.
(c) required candidates to plot 3 inequalities and label the feasible region. It was surprising to see how few candidates were able to gain much credit on this part. Of the three inequalities $4x + 3y \leq 1500$ was the only one that was regularly plotted correctly, despite graphs such as $y = 2x$ and $y = \frac{1}{3}x$ being on the foundation GCSE syllabus. If only one line was drawn correctly, no further credit could be awarded, and unfortunately this was the case for many candidates.
Part (d) provided a challenge for many, as they had failed to read the sentence stating the number of t-shirts and skirts would be the same. This led candidates to either attempt to work in 3 different variables still, or more commonly, to ignore the number of skirts altogether. That said, there were a good number of candidates who knew to extract a coordinate from a vertex of their region and test it in the objective function, and so some credit was attained. Some candidates who knew they needed to use vertices, were very careless with their reading of the coordinates from the graph. Due to their misunderstanding with the objective function, many were able to gain no more than 2 marks for beginning to test one of their vertices. To gain the second M mark or the A mark, they should have been using the correct objective function, and the C mark came from using 2 coordinates correctly and making a clear conclusion. (ii) required the candidate to then extract the context from their outcome in (i) to state the number of each item, and the maximum daily profit. Unfortunately for many, if their region in (c) was incorrect, the most that could be achieved here was a single mark. Many of those who had got previous parts correct, went on to gain credit here also.
(e) was answered typically well, and much like 2(b)(ii) many candidates were able to find examples of suitable external factors that were being assumed to not change.

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